



# LXIV. Further experiments on the solubility of certain metallic oxides and salts in muriate and nitrate of ammonia

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Together, the result is, for 100 parts,

Cyanide of potassium .....	53·4
Carbonate of potash .....	45·8
	99·2
Loss.....	·8

—a result confirmatory of sodium being present in small quantity.

That the salt contained no caustic alkali was thus proved. Into a weak solution of the salt, a solution of nitrate of silver, likewise weak, was dropped. The precipitate was *white*, as would occur from a solution either of cyanide of potassium or of carbonate of potash. Into a similar solution of the salt, one or two drops of a weak solution of caustic potash were let fall, and, *afterwards*, one drop of the nitrate of silver solution; whereupon the *light grayish brown*, indicative of the precipitation of oxide of silver, at once appeared. The absence of this light grayish brown in the previous experiment demonstrated the absence of caustic potash or caustic soda in the salt under examination\*.

Marischal College, March 13, 1837.

LXIV. *Further Experiments on the Solubility of certain Metallic Oxides and Salts in Muriate and Nitrate of Ammonia.*

By R. H. BRETT, Esq., F.L.S.

SINCE publishing my paper in the February Number of the Philosophical Magazine, p. 95, I have made further experiments on the same subject, the results of which I now offer for insertion at this time, more especially since a recent criticism has appeared, p. 178, not at all invalidating the accuracy of the experiments, but complaining of what the author terms a “serious omission” likely to produce an erroneous opinion as to the cause by which certain metallic oxides and salts are brought into solution under certain circumstances. My object, in the paper to which I have alluded, was to state certain facts, which I believed to be of considerable importance in chemical analysis, and an ignorance of which must lead to serious errors, especially in certain quantitative investigations. Your correspondent disapproves of the term *soluble in muriate or nitrate of ammonia*, and had I expressly stated that such solution takes place in every instance, without decomposition of the ammoniacal salt employed, I should doubtless have committed a grave error; such, however, was never my belief, and the exact nature of the changes which took place, was

\* In reference to the subject of Dr. Clark’s paper we may cite a notice in Phil. Mag., First Series, vol. lxii. p. 234.—EDIT.

not the subject of my inquiry; to find fault with the expression is therefore, I think, rather hypercritical, as it would be in the common expression that certain metallic bodies, such as zinc or silver, are soluble in nitric acid; for any one using such a term in reference to those substances would doubtless know that before such solution could take place, the acid must undergo decomposition. The experiments which I performed, as well as a repetition of those referred to in my last paper as instituted by M. Vogel, and afterwards by Mr. Smith, could not but have informed me of the fact that the ammoniacal salt does under certain circumstances, if not in all cases, suffer decomposition.

I shall now briefly mention the results of my late experiments on this subject. The oxides and salts operated upon were well washed on filters with distilled water, and allowed to dry at the temperature of the room.

*Barytic Salts.*—The carbonate and phosphate of baryta, when digested in cold muriate of ammonia in solution (a saturated solution), yield a fluid which, after filtration, contains the earth in some form of combination, it being readily precipitated by dilute sulphuric acid: ammonia in excess causes no precipitate.

*Strontian Salts.*—Precisely the same results were obtained.

*Lime Salts.*—The neutral phosphate of lime which possesses a semi-crystalline appearance, and was obtained by adding a neutral solution of phosphate of ammonia to a solution of chloride of calcium in excess, as also the subphosphate, altogether devoid of crystalline structure, and obtained by adding an excess of the salt of lime to the phosphatic salt, containing, according to Berzelius, 1 and  $\frac{1}{2}$  more lime than the neutral salt\*, when digested in the cold with the saturated solution of muriate of ammonia, yielded by filtration a fluid which was abundantly precipitated by oxalate of ammonia, and therefore contained lime in some form of combination. It may be observed that ammonia added in excess to the filtered fluid obtained by digesting any of the above salts, barytic, strontian, or calcareous, did not cause any precipitate.

*Magnesian Salts.*—The carbonate and ammoniaco-magnesian phosphate are similarly acted upon.

*Oxide and Salts of Cadmium.*—The oxide, carbonate, phosphate, and oxalate of cadmium, when digested in a cold saturated solution of muriate of ammonia, yielded a fluid by filtration, abundantly precipitated of a yellow colour by hydrosulphuret of ammonia.

*Salts of Cobalt.*—The carbonate and phosphate when di-

\* Berzelius, *Traité de Chimie*, tom. iv. p. 71 *et seq.*

gested in a cold saturated solution of muriate of ammonia yielded, by filtration, a fluid abundantly precipitated of a black colour by hydro-sulphuret of ammonia.

*Oxide and Salts of Manganese.*—The brown coloured hydrated deutoxide of manganese when digested in the ammoniacal salt yielded, by filtration, a fluid which was precipitated by hydrosulphuret of ammonia, of the peculiar pale flesh-colour characteristic of salts of manganese; it is not improbable, however, that the oxide operated upon, although apparently of a uniform brown colour, might have contained a little protoxide which had not passed into the state of deutoxide by aerial exposure. Phosphate of manganese when treated in the same manner yielded, by filtration, a fluid which was similarly acted upon by hydrosulphuret of ammonia.

*Oxide and Salts of Copper.*—The hydrated peroxide of copper, the black anhydrous peroxide, and the carbonate of copper, when digested in cold muriate of ammonia yield, by filtration, a blue coloured fluid, evidently containing the metallic oxide in some form of combination.

*Salts of Bismuth.*—The subnitrate of bismuth of the shops, when digested in a cold solution of muriate of ammonia or boiled in the same salt did not yield, by filtration, a fluid which yielded a black precipitate by hydrosulphuret of ammonia; the same may be said of the salt when recently precipitated, well washed and dried at the prevailing atmospheric temperature.

The same applies to the protoxide and certain protosalts of tin.

*Salts of Silver.*—The chloride, carbonate, and phosphate when prepared without exposure to light, and digested in the ammoniacal salt, without exposure to light also, yielded, by filtration, a fluid which was precipitated black by hydrosulphuret of ammonia.

*Persalts and Oxide of Mercury.*—The peroxide, carbonate, phosphate and biniiodide, when digested in a cold solution of muriate of ammonia yield a fluid, which is abundantly precipitated of a black colour by hydrosulphuret of ammonia.

Some other metallic oxides and salts still remain to be operated upon; but as circumstances prevent me from carrying on the inquiry at the present moment, I must defer the consideration of them to a future period.

March 2, 1837.

R. H. BRETT, F.L.S.

N.B. It will be observed that the results arrived at with the salts of bismuth are different from those mentioned in the former paper, p. 98; but it must be remembered that they were operated upon under different circumstances as then noticed.